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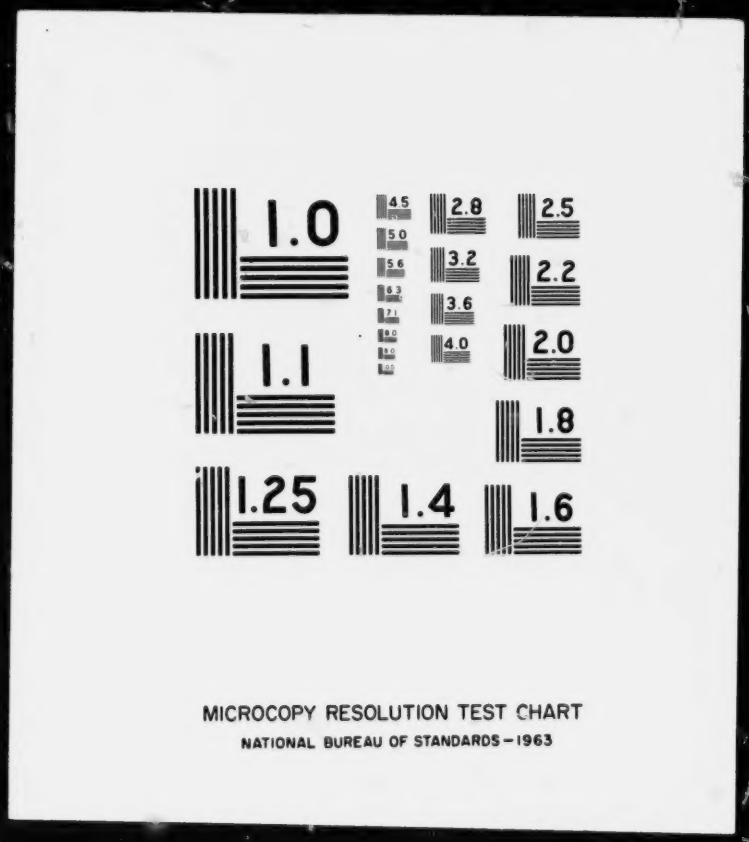

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The purpose of systematic teaching and learning in arithmetic is to help children develop ideas of procedure, methods of thinking, meaning inherent in number reactions and arrangement in order that the quantitative situations of life may be handled intelligently. At the kindergarten-primary level the number concepts to be fostered are: putting together, taking apart, counting and measuring. Some activities which might give meaning to arithmetic for young children include: telling time, counting money, paying bills, buying postage stamps, planning parties, measuring toy furniture, reading house numbers, using the telephone, using a calendar, reading thermometers, and keeping scores. As pupils progress to the intermediate level, their abilities and experiences in the use of numbers also increase. The number concepts to be developed in the intermediate grades are addition, substraction, multiplication, and division of integers, fractions, and decimals. Some of the meaningful activities for intermediate children might include: linear measure, liquid measure, finding averages, using Roman numerals, making cut-outs for fractions, drawing graphs, learning to shop, learning the names of geometric figures, drawing to scale, and reading road maps. A list of arithmetical vocabulary words, expected outcomes, and bibliographies of published arithmetic material are included for both levels.

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WE USE ARITHMETIC

W E U S E A R I T H M E T I C

A SUPPLEMENTARY BULLETIN

CURRICULUM LABORATORY

CALIFORNIA STATE DEPARTMENT OF EDUCATION

Prepared by

The Division of Elementary Education

Muriel Crosby, Director

WILMINGTON PUBLIC SCHOOLS
WILMINGTON, DELAWARE

1954

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F O R E W O R D

The period during which a few "experts" in curriculum revision worked behind closed doors with paste-pot and scissors has long since drawn to a close. Storage shelves are burdened with the results of their labors. Courses of study once regarded as the final word have been filed away for good. May their repcse remain undisturbed.

Over the past three years our staff has been busy developing new teaching materials. Our problem has been largely one of providing the time and opportunity for participation by all who wished to have a part in the formulation of these guides. We recognized from the first that those who must use the new materials should share in their preparation and in trying out with their pupils the ideas presented for consideration and adoption. The release of a large number of staff members to serve on committees and to devote many hours in producing, editing and checking the content and procedures advocated has required careful planning as well as considerable financial outlay.

How well this problem has been solved is indicated by the fact that 95 per cent of the teaching staff of the elementary schools have shared in the development program. Many teachers have contributed much in ideas and critical evaluation.

These guides are offered as the point reached at the present time in the thinking of the group. Undoubtedly they will be changed as further study and classroom use suggest the need for revision.

It is our hope that teachers and parents will find them useful as well as informative.

--------- Ward I. Miller

A POINT OF VIEW

WE USE ARITHMETIC is designed to express a point of view and practices in teaching children arithmetic consistent with the findings of research in the ways in which children in the elementary school learn.

We believe that children learn arithmetic best when they have a need to use it.

We believe that children learn arithmetic best when they have experiences which give meaning to the arithmetic to be learned.

We believe that systematic teaching is essential in the learning of arithmetic and that the skillful teacher will plan experiences for children which will stimulate a need for direct teaching and learning, much practice in real situations, and drill when it is essential in mastering arithmetic processes.

We believe that as children learn arithmetic they learn, also, to like it or to hate it. We hope that the suggestions in this bulletin will help teachers teach their children to use arithmetic and to like it.

------ Muriel Crosby

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SECTION I

THE KINDERGARTEN-PRIMARY LEVEL

The Child's Need to Learn Arithmetic

Young children, like others, use arithmetic in all aspects of daily living. Through provision for many kinds of activities in school, the teacher uses the child's purposes and interests to foster a program of systematic teaching and learning of arithmetic. The child's need for learning to understand and use arithmetic arises from his experiences. The teacher helps the child become aware of the need for systematic learning of arithmetic as a means of achieving his own goals.

The purpose of systematic teaching and learning in arithmetic is to help children develop ideas of procedure, methods of thinking, meanings inherent in number relations and arrangement in order that the quantitative situations of life may be handled intelligently.

The child's learning of any arithmetic concept or skill is for the purpose of solving problems that he is actually meeting; the successful solution of such problems enables him to function more fully and intelligently in his world.

Good teaching recognizes that arithmetic learning is a slow process at best, and that the activities involved in the discovery and generalizations must be spread over a long period of time. The learning of arithmetic for each child has to be meaningful and interesting to him.

Systematic learning should occur from real need. Arithmetic is highly abstract and if children are to become intelligent, efficient users of numbers their initial learning activities must be as concrete and realistic as possible. Experiences which enable the child to become acquainted with real situations that involve the spending and saving of his allowance, telling time, keeping scores, playing store and making change are typical examples.

Problem work on the primary level is not to be confused with counting. The child does not need to count to comprehend the meaning of more or less. The idea of equal can be grasped without counting. Development is often from the whole to the part, from the general to the specific. Counting is a particularized, specific, refined method of dealing with groups of objects. It involves a perception of the relationship of the part to the whole.

Number Concepts to Be Fostered on the Primary Level

There are four concepts upon which the arithmetic program of the primary school is based: putting together, taking apart, counting and measuring.

In the section which follows examples of meaningful arithmetic situations have been suggested as a means of helping children develop the important concepts, relationships and computational skills needed in arithmetic to make learning permanent.

Typical School Activities Which Give Meaning to Arithmetic

Letter Writing

One girl's father was working in Denver, Colorado. Another girl's father was working in Houston, Texas. They wrote letters to their fathers. They talked about how far these cities were from Wilmington. The class went to a sixth grade room and used a map to locate the cities. Some sixth graders measured the distances in miles. All the pupils shared this experience.

Wayne wanted to send a letter to his uncle in Maryland. He went to the school office and bought a stamp. He had a nickel; when he came back he had two cents. The class discussed the cost of stamps. Could you buy two for a nickel? What was the value of different stamps? The children brought some stamps to school. An older boy visited the room and displayed his collection. The class visited the city post office.

Being on Time

Billy was late. The teacher asked if anyone knew what time it was. Ann said, "Twenty-five after nine." She told the class that she could count by fives and pointing to the clock said, "Five, 10, 15, 20, 25 minutes. Billy is 25 minutes late."

Creating an Attractive Room

We wanted to do something to make our room attractive. The children decided that they would like some potted plants. Each child brought ten cents. We collected $3.10. A group of children went to the store and bought the plants. They gave a report to the class and showed the sales slip.

Daily News

This notice appeared on the blackboard as part of the news for the day:

Phyllis has new red shoes.
Grace has new white shoes.

two red shoes two white shoes
four shoes
two pairs of shoes

Games

John and Sue played a game. They kept score on the board. They said the score after each turn. The score was a tie at 3 to 3 and 9 to 9, then John won by one point.

Planning a Party

A chart in a first grade room, written when planning a party, illustrates a meaningful arithmetic situation.

We went to the store.
We bought some jello
We had one dollar.
We bought five boxes.
We have 54 cents left from our dollar.
We spent one-half dollar all but 4 cents.
We spent 46 cents.

The class knew about half dollars from two previous experiences. Harry counted backwards from 50 to 46.

This same class planned the number of plates needed. The chart follows:

24 children
1 mother
1 young guest
2 teachers

28 plates are needed

March of Dimes

Children learned that 5 dimes are 50 cents. Ann said, "That is the same as a half dollar." A fifth grade girl came in the room. She had a paper dollar. It was for 2 cards, one for her and one for her sister in the first grade. The children learned that 50 cents and 50 cents are 100 cents and that 10 dimes make 100 cents, or a dollar.

Using the Calendar

Each day we write the day, month and year on the blackboard. As each new month comes, the children change the calendar and repeat the names of the months that they have been in school. They have also learned the days of the week, how many days in a week and in a month and how many months in a year.

Milk Time

Each day the children drink milk. The milk comes in half-pint bottles. One morning there was a bottle left. Gil said, "There is a pint of milk left." Charles said, "You mean a quart, a quart is what the milkman leaves on my step every morning."

The next day we had a grand time with a half-pint, pint and quart bottles. We measured water. We listed other known substances that are bought or sold by liquid measure.

Vocabulary Work

We had 16 reading words on the blackboard. The words were in groups of 4. Harry said, "How many are there?" Mary said, "I know." She went to the board and said, "These two fours make 8 and these two fours make 8. Eight and 8 are sixteen." This provided an excellent start to counting by fours.

Making Choices

We frequently voted in our room during the year. An example follows:

We had a reading chart about the lunch room. Four children drew pictures for this chart. We placed the pictures along the blackboard ledge. Each child put a chalk mark above the picture that he liked best. How many for each picture? The class could recognize 2, 4, and 5 votes without counting. The nine votes they had to count. We

then decided to use all four pictures. The picture that received nine votes was used the first week. The picture that received 5 votes was used the second week, and so on. This was a meaningful way to teach the terms, first second, third and fourth.

Using Books

Three children were reading the same book to me. When we finished Robert said, "We started on page 20 and stopped on 31; 20 and 10 are 30 and one more is 11. We read 11 pages today." The other two children looked at him and counted the pages.

Science Experiences

Thermometers. We have two thermometers in our room. One is in the room and the other one is outside the window. Our chart follows:

	Indoors	Outdoors
Monday	70	50
Tuesday	74	48
Wednesday	72	28
Thursday	70	31
Friday	68	22

We learned the word "degrees". We talked about the "difference" each day. We learned about the freezing point of water and the boiling point of water. We listed other uses of thermometers.

Our Aquarium. The following chart resulted from our experience in making an aquarium.

Our Aquarium

Mrs. W----- gave us an aquarium.

Our aquarium is 18 inches long, 9 inches high, and 10 inches wide.

Mrs. L--- read us a book, "How to Make an Aquarium".

We are going to bring pennies to buy gold fish, snails, and water plants.

Leon is going to bring some marbles for our aquarium.

Social Studies

While discussing a story about ice cream, we found that only three of the children in this third grade group had ever seen a hand turned ice cream freezer. We decided to make ice cream in our room. It became an arithmetic, language, spelling, writing and science lesson. One group worked on the ingredients, reading directions, mixing and measuring. Another group had the ice cream freezer to pack with crushed ice. They found out that rock salt was needed. Still another group acted as hosts and hostesses and clean-up committee. We made two gallons, enough for all to have a good taste of real homemade ice cream and we learned some real arithmetic.

The Clock Serves as Well

The clock face is excellent for teaching arithmetic. We were studying about foods and the "six times" at the same time. We made a device for checking what we knew. We cut out from magazines 12 different kinds of soup and mounted them on a square of oak tag just as the numerals on the clock face are arranged. Under the numerals we placed the bowls of soup. In the center we placed a number and attached hands to it. Even though we needed only one hand to play the game, we put two hands on so that the same clock could be used to tell time. The number in the center can be changed (up to 10). This can be used for all four arithmetic processes.

Special Times

An Arithmetic Christmas Tree. We used the Christmas tree during the month of December as an aid in teaching addition and subtraction. We cut out a large tree and mounted it on the bulletin board. The children brought in catalogs with colored pictures that listed the prices of the toys and various articles. They cut out and pasted these articles and toys on the tree. During our arithmetic and study time the children chose the gifts they wanted to buy for their friends and family and added the cost. Sometimes they had a certain amount of money to spend. They subtracted the total cost from the cash in hand. An example follows:

doll coach	$ 5.95	$ 25.00
doll	$ 3.95	-18.85
wagon	$ 8.95	
		$ 6.15
total cost	$18.85	

The children learned to use the dollar sign and the decimal point, also the importance of keeping the dollars and cents in straight columns.

Ready for the Intermediate Grades

Skills, Understandings and Attitudes for the Kindergarten and Primary Grades

A child should understand that arithmetic is a language of quantity and that numbers apply to a quantity of something. He should understand the spoken and written symbols with which to think and communicate quantitatively. He should show increasing ability to count, measure, compute, estimate and reason as he thinks quantitatively.

A child should recognize the usefulness of arithmetic and its practical and scientific applications. He should know that arithmetic is not just something that he does in school. The function of any good arithmetic program should be to teach the child to use his arithmetic in his everyday life. If a child uses his knowledge, he is eager and willing to learn more.

A grade placement guide is never accurate, but it is often helpful for the teacher to check the progress of a group.

Kindergarten and Grade One

1. Count and read numbers to 100
2. Use money
3. Associate the clock with time to play, time to rest, time for lunch
4. Know address and telephone number
5. Understand the terms $\frac{1}{2}$ and $\frac{1}{4}$ and a whole group or a whole object
6. Begin to understand terms of measurement
7. Make comparisons

Grade Two

1. Count by 1's to 200; by 5's and 10's to 100; by 2's to 50; by 3's to 15
2. Know number facts in addition and subtraction to 10.
3. Add two columns - no carrying
4. Subtract two columns - no borrowing

5. Tell time by hour, half-hour and quarter-hour

6. Recognize currency and make change

7. Solve simple mental problems

Grade Three

1. Read and write three figure numbers to 200

2. Solve one and two step problems involving all four processes

3. Know addition facts (sums not over 10, written in horizontal form)

4. Know subtraction facts (minuends not to exceed 10)

5. Know column addition
   Two and three place digits
   Carrying in tens and hundreds

6. Multiply using one and two digit multiplier

7. Understand division - simple facts of short division

8. Measure distance and size

9. Keep records and scores

10. Begin to develop a respect for the importance of accuracy

Grade Two should review the work of Grade One and Grade Three should review the work of the first two grades. Whenever possible a new number experience should be related to an old experience. Always be sure that one process is understood and that the child is fairly competent before moving on to the next step.

Primary boys and girls should have experiences with many of the following:

Telling time	Bus numbers
Days of the week	Club records
Months of the year	Making bills
Liquid measure	Paying bills
Dry measure	Keeping scores
Committee groups	Counting money

Savings accounts	Postage
School bank record	Selling papers
Bus fare	Running errands
Play store	Using a calendar
Sales slips	Measuring toy furniture
Page numbers	Cutting doll dresses
Telephone numbers	Comparing weights
Room numbers	Lunch money
House numbers	Planning parties
Comparing heights	Distances
Weather reports	Movie money
Allowances	

Primary children should also have a broad arithmetical vocabulary:

across	group	pint
add		
addition	half	quart
after	high	quarter
among	higher	
	highest	record
before	hundred	
between		score
big	inch	slant
bigger		small
biggest	large	smaller
breadth	larger	smallest
buy	largest	square
by	length	subtract
	less	subtraction
circle	level	
committee	little	thousand
count	long	ton
	longer	
decimal	longest	up
divide	low	under
division		
dollar	many	whole
down	mile	wide
	more	wider
equal	multiply	widest
even		width
	narrow	
far	near	yard
feet		
first	over	zero
foot		

Some groups will have more word concepts, while other groups will have great difficulty understanding arithmetic language. This list is only a guide for the teacher.

Some Do's and Don'ts

1. Do consider the number background of your group.

2. Do have arithmetic groups. Children differ in arithmetic ability. These differences continue throughout life. The teacher's job is to plan for steady progress built upon what has gone before in each individual case.

3. Do give the child an opportunity to discover relationships between numbers in his play activities. (e.g. Rungs on a ladder, jumps in hop scotch)

4. Do encourage the child to talk about the w ays he uses numbers and money at home. (e.g. Setting the table, saving for vacation)

5. Do let the child handle objects for grouping, counting or any process.

6. Do take time to connect arithmetic with the other activities in the group (pages in book, number of seats at a lunch table, new books in the library, class attendance).

7. Do have an arithmetic box or an arithmetic corner (blocks, sticks, marbles, toy cars and planes, empty spools on a shoe string).

8. Do use visual aids (picture charts, games, toy money, dominoes, room windows).

9. Do let children count all money collected in the room.

10. Do present steps of any organized work in sequence.

11. Do proceed from the concrete (real objects) to the semi-concrete (pictures) to the abstract (symbols).

12. Do drill, but only after the facts are understood. Drill should help develop greater speed and accuracy. Drill is often not well planned. It may offer more practice than is needed on some elements and inadequate practice on other elements. Drill should be well planned and serve the needs of the group.

1. Don't give every child in a group the same arithmetic assignment.

2. Don't use arithmetic as a punishment.

3. Don't give young children long lists of examples, objects, or problems to copy from the blackboard.

4. Don't teach arithmetic by the application of memorizing rules.

5. Don't use arithmetic aids that are confusing. (How are rulers and yardsticks marked? Does the quart measure really hold a quart?)

6. Don't ask children to use their reading books to check written numbers unless you have checked the books for accuracy. (Some reading books do not have all the pages numbered. Some pages are completely covered with pictures.)

7. Don't take the results of standardized tests too seriously. They usually consist of exercises requiring computational skills and problems to be solved and neglect other important phases of the arithmetic program.

8. Don't judge the accomplishment of a child entirely by his score made on a standardized test.

9. Don't expect all children to learn arithmetic skills or acquire quantitative understandings at the same rate of speed.

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SECTION II

THE INTERMEDIATE LEVEL

The Child's Need to Learn Arithmetic

As pupils progress to the intermediate level, their abilities and experiences in the use of numbers also increase. The development of sustained appreciation of arithmetic through experiences should enable each child to grow at his own rate of speed. Practical situations should be extended to provide use of estimation and judgment because it is a valuable asset in every day living to be able to estimate, to recognize plausible answers, and to appraise methods of handling situations. For example, as they work with decimals children begin to recognize an analogy with many personal types of money problems such as $\frac{1}{4}$ being .25; $\frac{1}{2}$, .50.

Problems of measuring have a continuing importance. Containers of pint, quart, and gallon size can be used for experiments in pouring. Determining their own heights and weights by means of weighing scales and wall charts is always a source of great personal satisfaction to children. A study of the calendar can be motivated by interests of special observance, holidays and birthdays. A study of the day's plans can help in telling time if children are not yet adept at it. Rulers, yardsticks, and tape measures can be used in effective actual situations. Assembling and measuring materials for recipes, collecting and counting money for school milk, itemizing class purchases are other familiar ways to use numbers.

Hobbies involving measurements, costs, and other arithmetical features can be utilized. Interest in the community may lead to a study, on a simple scale, of costs of operating civic projects with which they have personal contact, such as playgrounds, ice-skating rinks, and swimming pools. Going to the store both with and for parents is an excellent experience. Scoring of games, keeping of personal records and charts are good first-hand experiences and concrete teaching aids.

These aids and methods serve as a transition from manipulative, concrete, and semi-concrete levels to the higher aspect of symbolic thinking. Quantitative thinking plays a more important role in our age than it has ever done before.

Our Purposes

The purposes involved in the teaching of arithmetic are to assure that each child acquires, to the maximum of his ability, those essential basic understandings and the meaningful, significant concepts of quantity and measure; a knowledge of the natural number system; the meaning and function of the fundamental processes of addition, subtraction, multiplication and division; an understanding of the generalized abstractions that apply to the rational number system. On the primary level, arithmetic, like other subjects, is taught through meaningful social situations. This approach also is important on the intermediate level. In addition, the child is now ready to approach arithmetic through a logical sequential development and generalization. Since learning takes place more readily if developed through meaningful social problems, it is recommended that at all levels we start with the concrete and proceed to the abstract.

An alert and sensitive teacher will take advantage of every social situation in or out of school which lends itself to quantitative work in the classroom. The good teacher sifts and uses the most meaningful and useful of these social situations. Since arithmetic is a logical-sequential subject, as well as a social subject, it is very necessary that the teacher know the development of each child rather than the grade placement to make sure that no child misses any of the sequential development.

Desirable attitudes toward arithmetic, discussed in Chapter III of the Foundation Guide, should be developed. These lead naturally to an increased satisfaction in using arithmetic correctly and confidently. The normal experiences of the child should serve as a background at each stage of development to heighten the interest and meaning of arithmetical problems. Step by step procedures with a skillful combination of what is already familiar and what is to be newly learned produce a psychologically sound program when, of course, definite provision is made for individual differences. Skills and understandings can best be maintained by a two-fold practice in (1) discovering and exploring new situations, (2) computing and solving problems competently.

The child should be able to identify his school work with his own daily experiences with numbers. The teacher should help the child see this relationship. Ability to think through the problem logically is an important goal for the child.

Number Concepts to Be Fostered on the Intermediate Level through Meaningful Activities

In the intermediate grades the following processes are developed: addition, subtraction, multiplication, and division of integers, fractions, and decimals.

This section contains illustrations of meaningful arithmetic activities suggested as a means of helping children acquire permanent possession of concepts, relationships, and computational skills.

Spending Money

The room was filling a Junior Red Cross box. Each pupil brought money and gave it to a committee selected by the class. When the time for collection had ended, the committee went to the ten-cent store and purchased as many articles as they could. They made their report to the class, bringing back the sales slips and explaining carefully all of the details.

Linear Measure

The children marked off their estimates of 1 in., 1 ft., and 1 yd. on the blackboard or large piece of paper. The other children checked these measurements for accuracy.

The children used parts of their bodies as reference units. They found height, arm length, length of foot, waist measurement, etc.

Liquid Measure

Children brought quart, pint, one-half pint bottles to school. They took these bottles to the sink and filled them with water and started measuring. They found the answers to these problems:

What part of a pint is 4 oz.?
Is 7 oz. of milk more or less than a half pint?
How many pints make a quart?
Which is more, 2 pints or a quart?
Which costs more, a quart of milk or a pint of milk? Why?

Finding Averages

Temperature readings were recorded daily for the morning and the afternoon. The average temperature for the day, week, and the month was then found.

The children could remember the differences in the "feelings" of the weather and came to better understand the meaning of "average" and the degree markings on the thermometer.

Children bought Savings Stamps each week and kept a chart:

Savings Stamps

1st week	$ 6.50
2nd week	5.20
3rd week	8.00
4th week	9.10
Total	$28.80
Average	$ 7.20

Using Fractions

The girls made Christmas cards. They decided that a good size for a card would be $5\frac{1}{2}$" long and $4\frac{1}{2}$" wide. They drew a rectangle that size. This taught them to be accurate so the cards would fit in the envelopes.

A Tricky Trick

Write down a number.
Add 9 to it.
Multiply the answer by 2.
Subtract 4.
Divide the remainder by 2.
Subtract the number you started with.
Your answer should be 7. Is it?

This teaches them to follow directions accurately.

Long Division

The fourth and fifth grades made a trip to the Philadelphia Zoo. There were 132 in the fourth grade and 160 pupils in the fifth grade. The committee found out that only 30 could sit comfortably in a bus. They had to find out how many buses were needed.

Using Dollars and Cents

Chief Sunrise gave a program in our school. The admission was 15¢ each. Miss T.'s room reported $4.50; Mrs. B.'s room, $3.75; Miss E.'s room, $4.50; and Miss L.'s room, $5.40. What was the total amount reported? Did they have enough money to pay him $15? How many children in each room bought tickets? How many children attended the show? How much money was left for the school to use after Chief Sunrise was paid?

Learning the Names of Geometric Figures

Circle, rectangle, triangle, right angle, and a square

Questions:

What kind of geometric figures do you see in your classroom?
What kind of geometric figures do you see out of the window?
What geometric figures do you see in this drawing?

Can you cut a rectangle into 2 triangles?

Draw a boy or an animal using nothing but geometric figures.

Draw a kite showing that it is made of triangles.

Fractions

Use your ruler.

Which is longer, 3/8 in. or $\frac{1}{4}$ in.?
How many inches are there in $\frac{1}{2}$ yd.? In $\frac{1}{4}$ yd.?
Which is longer, $\frac{1}{2}$ ft. or 1/3 ft.?
Draw a line 5/8 in. long; 1 5/8 in. long; 2 5/8 in. long.
Several children are chosen to check this measuring at the boards. Measurements must be accurate.

Learning How to Shop

Cocoa	Salad Dressing	Baking Powder
8 oz. box 25¢	$\frac{1}{2}$ pt. jar 27¢	4 oz. box 16¢
1 lb. box 47¢	1 pt. jar 50¢	8 oz. box 31¢
2 lb. box 89¢	1 qt. jar 94¢	1 lb. box 59¢

The children like to shop this way:

How much would you save by buying a 2 lb. box of cocoa instead of two 1 lb. boxes?

How much would you save by buying a 1 lb. box of cocoa instead of buying 1 lb. in 8 oz. boxes?

Which is cheaper, to buy a qt. jar of salad dressing or buying a quart in pint jars?

How much could you save by buying a 1 lb. box of baking powder instead of buying a pound in 4 oz. boxes?

Decimals

The elevens had been working with common fractions, decimal fractions, and some simple percentages using rainfall averages, batting averages, and speedometer readings that they had found and brought in. Some few children were still having difficulty comprehending that a decimal fraction was like a common fraction whose denominator was a component of ten. The idea of percentage being based on one hundred parts was also causing trouble.

John and Dick offered to help these classmates by making a teaching illustration. They drew a strip on a large chart and divided it into ten parts. Each part was then divided into ten more parts. The boys labelled the divisions with the decimal equivalents and percentage

signs. Then they worked with individuals or small groups wanting explanations or help. John and Dick helped the children find and write decimal, common fraction, and percentage facts using the chart until the facts were understood.

$.2 = \frac{2}{10} = \frac{1}{5}$

$.5 = \frac{5}{10} = \frac{1}{2}$

$.8 = \frac{8}{10} = \frac{2}{5}$

$\frac{1}{100} = .01 = 1\%$

$\frac{10}{100} = \frac{1}{10} = .1 = 10\%$

$\frac{50}{100} = \frac{5}{10} = \frac{1}{2} = .5 = 50\%$

Raising Money to Buy Pets

The class in a discussion brought out the fact that they would like some pets for the room. They were interested in Japanese Waltzing Mice. How to pay for them was a problem since they found out that they were $2.50 each.

They decided to sell stamps, American and European. Posters were made, reports to other classes were given, which required quite a bit of salesmanship. They were successful with the sale, and more than enough money was raised to buy pets, material to construct a cage, and to buy food. The outcomes were:

1. They had actual experience with planning and measuring.
2. The class worked together to make the sale a success.
3. The children enjoyed mice because they had bought them with their own money.
4. The care of the mice was a continuing responsibility.

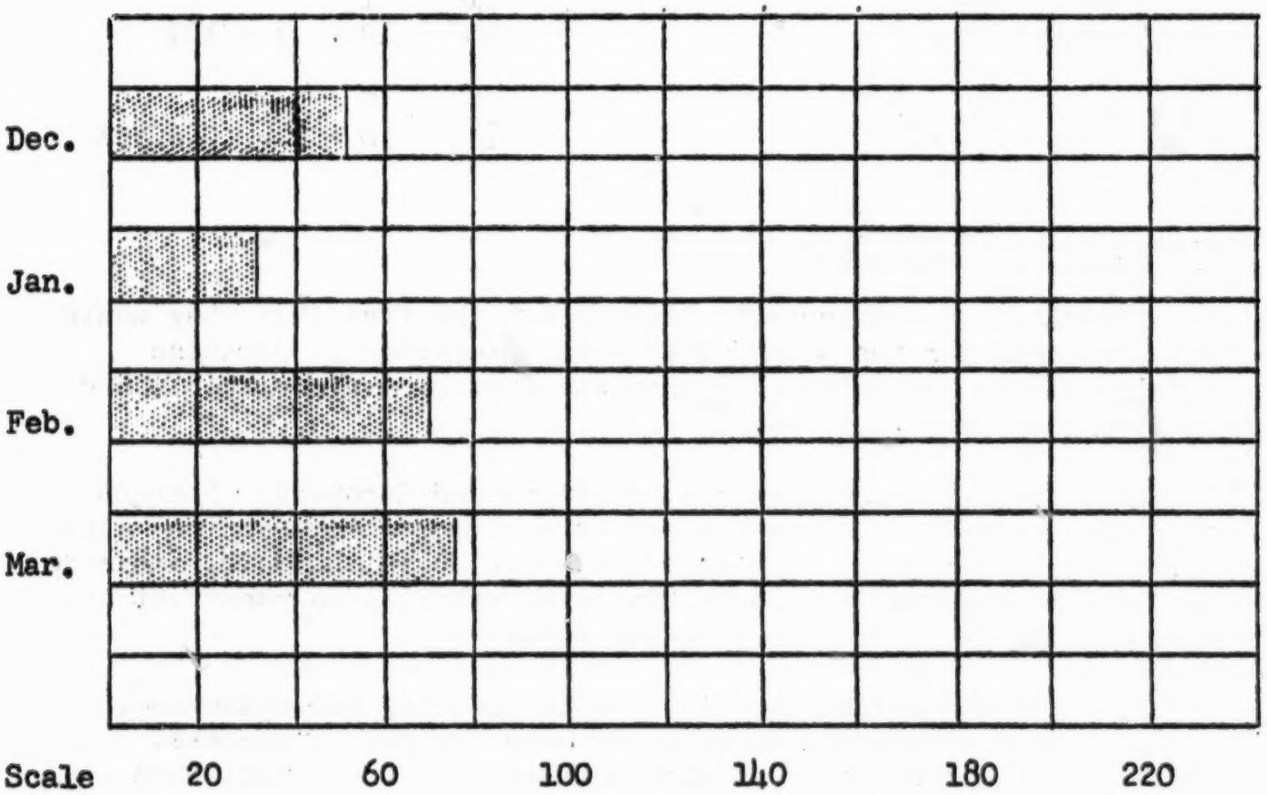
Drawing to Scale

Bob's family was planning a new house. He brought in the blue prints to show to the other children. They became interested in scale drawing and decided to try some. With the teacher's help, everyone drew a stick figure of himself and his desk to scale. Then the boys and girls decided to do different things for an exhibit. Some worked together, others individually. The exhibit was a great success. There were drawings of the schoolroom, its furniture, toys, rooms and furniture from home, the school building, the playground, and even the state. Minature planes, cars, and engines were shown and their scale explained.

Graphs

In December our room saved $50.00 in stamps, in January $32.00, in February $68.00, and in March $75.00. We decided that it would be interesting to show to our parents and visitors just what our room had done each month. This is our graph so far:

Savings Stamps Graph



The children were so interested in this graph they wanted to make other ones. They gathered real facts and information to be depicted, such as: profits from their seed sales, pupils' heights, tardiness and attendance records of boys and girls, frequency with which class members viewed television programs, etc. Committees went to work and produced different kinds of graphs: symbol, bar, circle, and line that had significant meaning for them.

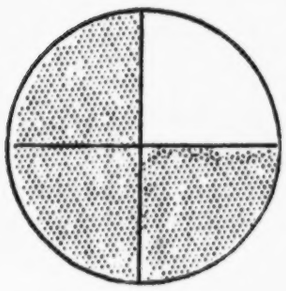
A study of our school population from 1942-1952 was made. We wrote a letter to the office requesting the records of enrollment. Each figure in our graph represented so many children. We asked the art teacher to help us with color and form. We realized that the War Years had brought a change in the school population. We were made aware of the importance and use of graphs in daily life.

Cut-Outs for Fractions

Children like to make their own cut-outs of pies, apples, oranges, bananas, rulers, etc., using cardboard.

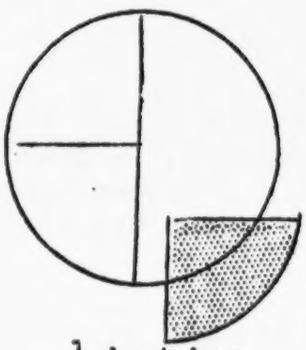
Subtracting like fractions:

A



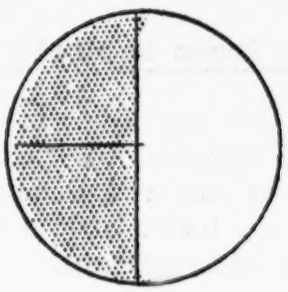
3/4 pie

B



$\frac{1}{4}$ is taken away

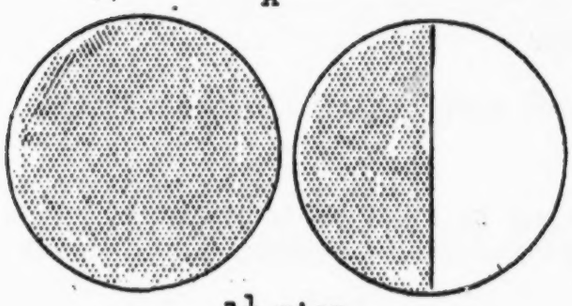
C



2/4 or $\frac{1}{2}$ pie remains

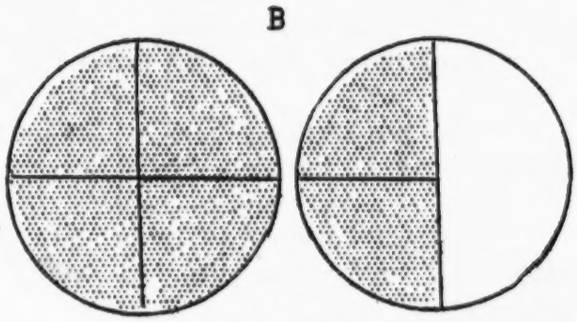
Subtracting unlike fractions:

A



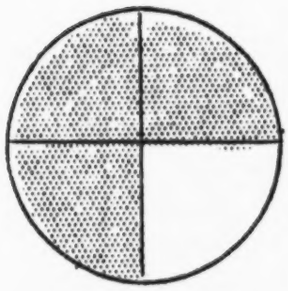
$1\frac{1}{2}$ pies

B

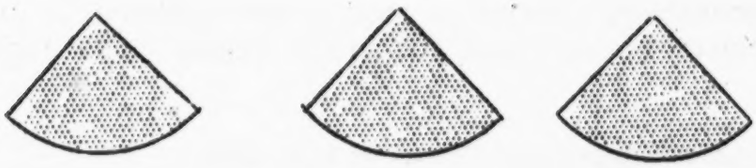


How many quarters?

C



$\frac{1}{4}$ served



3/4 left

Similar cut-outs were made and the fractional parts compared using squares and rectangles.

One day two children brought in birthday cakes for a class treat. The boys and girls figured the number of pieces needed, planned the cutting of the cake into fractional parts so that everyone had a piece of equal size.

Using Roman Numerals

One day the children came across several pages in their arithmetic books devoted to Roman numerals. A discussion followed and the question of their use came up. Everyone agreed to investigate and to find at least one example of our use of Roman numerals by the next discussion period.

These examples were brought in:

Numbering chapters in a book
Numbering main points in an outline
Marking the dates of several churches, public buildings, and our own school
Numbering hours on some old clocks

One boy even found a date in Roman numerals on the base of the pyramid on a one dollar bill.

The children had great fun learning to read these numbers. Then they all wrote the year of their birth and the present year in Roman numerals.

Several charts showing historical dates in Roman numerals were made. A clock face was drawn and numbered, as was a typical outline pattern.

By the end of the short study, all the children understood how the numbers were made and why their use in our number system isn't possible. Everyone could read numbers to 100 and many boys and girls could easily read and write higher ones just for fun.

Other Suggested Class Activities

Dividing the cost of a class party
Organizing trips and excursions
Reading time-clocks
Reading menus
Making change
Selling papers
Drawing maps to scale
Liquid measure
Dry measure
Keeping club records

Building model planes
Finding perimeter and areas of schoolroom
Comparing rates of travel by bus, plane, train
Reading road maps
Reading timetables
Understanding bills, checks, receipts
Keeping scores in games
Measuring rainfall

Vocabulary

Children in the upper elementary school should have a broad arithmetical vocabulary:

above
account
across
add
addition
afford
after
agree
ahead
all
allot
allowance
A.M. ante meridiem
angle
area
averages

back
balance
bank
bank book
banker
banking
bargain
base
begin
below
between
big
bigger
biggest
billion
borrow
both
bottle
bottom
breadth
budget
buy

calendar
cancel
caret
cent
change
check
choice
choose
circle
circumference
clock
coin
combine
committee
common
compare
comparison
compass
compute
content
corner
correct
correspondence
count
credit
cubes

day
decade
decimal
deed
decrease
dimensions
denominator
deposit
diameter
different
digit

dime
direction
dissimilar
dismiss
discard
discount
discover
divide
divisible
division
dollar
double
down
dozen
due

east
elevate
eliminate
endorse
enough
equal
essential
estimate
evaluate
even
every
exact
exchange
extend
extra

factors
farther
fast
faster
fastest
feet

fence
few
fewer
fewest
figure
final
find
first
foot
form
formula
fractional
fractions
frame
freezing point
front
fund

gain
gallon
gather
get
give
graph
gross
group
grow

half
half dollar
half dozen
half hour
half pint
heavy
heavier
heaviest
height
higher terms
highest terms
hire
hour
horizontal
hundred
hyphen

improper fraction
in
in all
in between
inch
increase
inside
integer
interest
invent
invert
invest

jar
join
judge
just as long as

kind
kinds
know
knowledge

lack
large
larger
largest
lost
least
least common denominator
left
likely
less
less than
level
little
locate
long
longer
longest
loss
low
lower
lower left-hand
lower right-hand
lower terms
lowest terms

many
measure
measuring
measuring cup
middle
middle sized
mile
million
minus
minute
mixed numbers
mixture
money
month
more
more than
most often
much
multiplicand
multiplier
multiplies
multiply

narrow
narrower
narrowest
near
nearer
nearest
nickel
north
notation
not any more
note
nothing
number
numerator

oblong
objects
odd
off
on
one
order
other
outside
over

pair
pairs
paper dollar
parallel

part
payment
pendulum
penny
per cent
percentage
perimeter
permit
pick
pint
place
plus
P.M. post meridiem
portion
problem
process
product
program
purchase

quality
quantity
quart
quarter
quickly
quotient

raise
rate
receive
rectangle
recent
record
reduce
reduction
reject
rent
relation
repay
retail
return
review
reward
right
ruler

sale price
same
save
savings
scales
score
seasons
section
select
self
sell
selling price
shape
share
short
shorter
shortest
sign
size
small
smaller
smallest
solid
solids
solve
some
south
sphere
square
subtract
subtraction
sum
surface

tall
tax
tenths
terms of a fraction
temperature
thermometer
thousand
time
together
ton
top
total
trapezoid
triple
trust

under
underestimate
understand
unequal
uniform
unite
unlike
until
up
upright

valid
value
variable
vast
vertical
vital
volume

wages
waste
weigh
weight
whole
wholesale

wide
wider
widest
will

yard
yardstick

zenith
zone
zero

A Suggested Outline of Content for the Intermediate Level with Suggested Outcomes

Grade placement lists of specific concepts and skills in arithmetic can never be accurate for any group of children. The following outline of suggested content and outcomes for the intermediate level may be useful to teachers in planning and selecting learning experiences suitable for the age or developmental level of the children in her group.

Grade IV

Activities

Telling time by clock - hour, half-hour, quarter-hour

Reading the calendar - day, week, month, year

Recording temperature

Making change

Computing cost of items bought in cafeteria

Buying refreshments for a party - dozen, half-dozen, pound, etc.

Collecting and counting money for various drives - Red Cross, Community Chest

Using a tape measure

Determining heights and weights

Comparing sizes of pint, quart, gallon containers

Abilities to Be Developed

Ability to understand integers and digit placements

Reading and writing numbers through one hundred thousand
Roman numerals from I to XXX

Ability to add

Column addition to include five numbers
Column addition using U. S. currency

Continue practice of column addition with carrying
Checking sums

Ability to subtract

Subtraction examples with four digits in minuend and subtrahend
Subtraction to include borrowing and the inclusion of zeros in the minuend
Subtraction involving U. S. currency
Checking results

Ability to multiply

Multiplication tables from 6 through 9
Multiplication with multiplicands of 3 and 4 place figures and multipliers with 2 place figures
The application of multiplication to U. S. currency

Ability to divide

Division facts for 6, 7, 8, 9 tables
Even division of one digit number 2 through 9 into dividends of 3 or 4 digit numbers
Extend short division to include principle of subtraction of dividends as a preparation of long division

Ability to solve problems

The development of problem solving abilities
Problems involving practical life experiences with money and measurements (liquid, linear, dry)

Outcomes

At the end of the fourth year the pupil with a reasonable degree of speed, accuracy, and neatness should have gained the ability to:

Read and write numbers through six places

Use Roman numerals to 30

Add five place numbers

Subtract four place numbers with borrowing using all types of zero difficulties

Multiply three and four place figures in the multiplicand, two in the multiplier

Divide by one place divisor into dividends of 3 or 4 digits

Solve problems involving the use of money, measurements, and practical situations

Grade V

Activities

Keeping a record of stamp sales

Collecting and counting club dues

Planning for trips

Keeping daily and weekly class roll

Recognizing relation of inches to feet, to yards, etc., when measuring, constructing, sewing

Counting steps in rhythm responses

Recording scores of organized play activities

Reading chapter headings in Roman numerals

Observing gain or loss in individual growth

Recognizing squares, circles, triangles, rectangles

Noting variation of prices of all items in stores

Measuring ingredients for cooking

Abilities to Be Developed

Ability to use integers

Understanding, reading and writing integral numbers to 9 places

Extending the use of Roman numerals to hundreds

Extending the ability to add, subtract, multiply, and divide
Multiplication 10, 11, and 12 tables, and extension of long multiplication to include 2 and 3 digit multipliers, with the inclusion of zero in the mutiplier

Division including long division with 2 digit divisors containing zero in divisors and dividends and quotients

Ability to use fractions

Nomenclature of fractions such as numerator, denominator, invert, least common denominator, mixed numbers

Addition of fractions
Like fractions to include halfs, fourths, eighths, sixteenths
Unlike fractions to include halfs, fourths, eighths, sixteenths, thirds, sixths, twelfths, fifths, tenths
Reduction of fractions

Subtraction of fractions
Including borrowing
The same fractions as numerated in addition and subtraction

Multiplication of fractions
Cancellation

Division of fractions
Inversion

Extend the principle of fractions to include mixed numbers

Ability to use denominate numbers

Measurement
Linear
Dry
Liquid
Time (second, minute, hour, day, month, year)

Practical applications in problem solving within the realm of the child's experience

Outcomes

At the end of the fifth year the pupil with a reasonable degree of speed, accuracy, and neatness should have gained the ability to:

Read and write numbers through nine places

Use Roman numbers to hundreds

Add, subtract, multiply and divide with integers

Add like and unlike fractions

Subtract like and unlike fractions, including borrowing

Multiply fractions, including cancellation

Divide fractions including inversion

Use denominate numbers

Solve problems of a practical nature

Grade VI

Activities

Keeping a record of money earned

Arranging for a class party

Comparing cost of different ways to travel

Estimating distances

Averaging class tests

Using common units of measurement - time, weight, liquid

Making simple scale drawings

Reading automobile speedometer, mileage marker

Balancing club accounts

Keeping batting averages of baseball favorites

Abilities to Be Developed

Ability to use integers

Addition - column, horizontal, and oral

Subtraction - column, horizontal, and oral

Multiplication - review of 3 digit multipliers and the use of zeros in the multiplier or multiplicand

Division - review of long division with checking including 3 digit divisors, and the five steps of division

Ability to use fractions

Addition of fractions and mixed numbers

Subtraction of fractions and mixed numbers

Multiplication of fractions and mixed numbers
Changing mixed numbers to improper fractions

Division of fractions and mixed numbers

Ability to use decimal fractions

Digit placement

Addition

Subtraction

Multiplication
Decimal placement

Division
Decimal placement and the use of the caret

Ability to understand decimal fractions in relation to fractions

Conversion of simple fractions to decimal fraction equivalent such as $\frac{1}{2}$ to .5; $\frac{1}{4}$ to .25

Conversion of decimal fractions into equivalent common fractions as .5 to $\frac{1}{2}$; .75 to 3/4

Ability to solve problems

Problems involving common fractions and decimal fractions

Ability to use simple percentage

Measurements
Business practice
Practical problems integrated with other subject areas

Outcomes

At the end of the sixth grade the pupil with a reasonable amount of speed, accuracy, and neatness should have gained the ability to:

Add, subtract, multiply, and divide with integers

Add, subtract, multiply, and divide with common and decimal fractions

Add, subtract, multiply and divide decimals

Change decimals to fractions and fractions to decimals

Solve problems involving common fractions and decimal fractions

Use simple percentage involving measurement, business practice, practical problems

Ready for Junior High School

By the end of the sixth grade, commensurate with his ability, the child with a reasonable amount of speed, accuracy, and neatness should have learned to:

Add, subtract, multiply, and divide with integers

Add, subtract, multiply, and divide with common and decimal fractions

Add, subtract, multiply, and divide decimals

Change decimals to fractions and fractions to decimals

Solve problems involving common fractions and decimal fractions

Use simple percentage involving measurement, business practice, practical problems

Select and use independently the processes needed to solve his social and personal problems

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See suggested texts on book list for Wilmington Public Schools

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